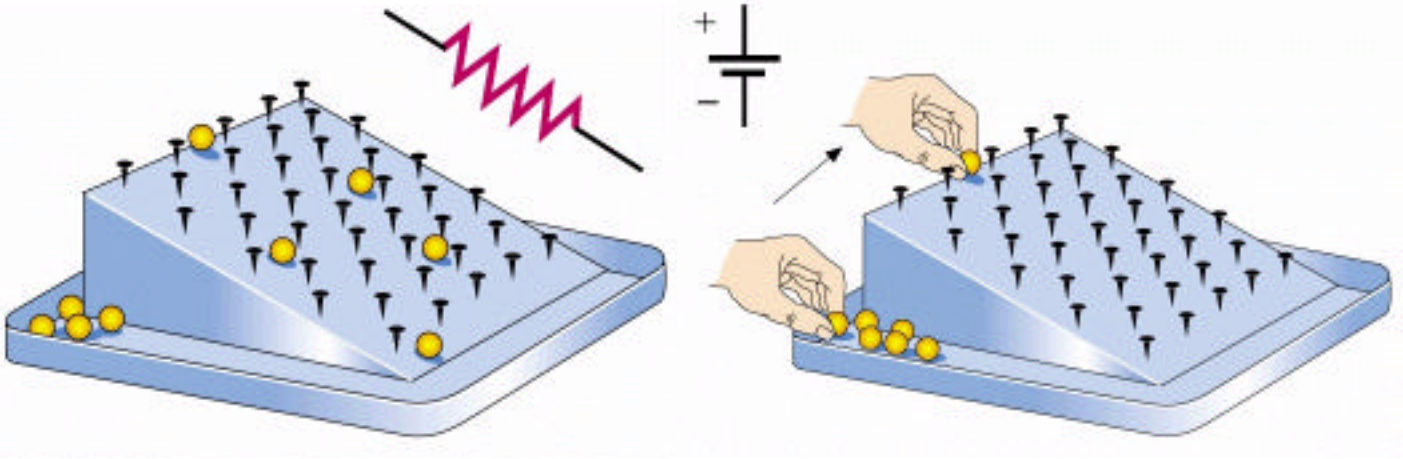
SP 222 Homework Chapter 26 Due MAR 1 2000
Name _____

1* • In our study of electrostatics, we concluded that there is no electric field within a conductor in electrostatic equilibrium. How is it that we can now discuss electric fields inside a conductor?

8 •• A 10-gauge copper wire and a 14-gauge copper wire are welded together end to end. The wires carry a current of 15 A. If there is one free electron per copper atom in each wire, find the drift velocity of the electrons in each wire.

11 •• In a proton supercollider, the protons in a 5-mA beam move with nearly the speed of light. (*a*) How many protons are there per meter of the beam? (*b*) If the cross-sectional area of the beam is 10^{-6} m^2, what is the number density of protons?

12 • Figure 26-8 illustrates a mechanical analog of a simple electric circuit. Devise another mechanical analog in which the current is represented by a flow of water instead of marbles.



13* • Two wires of the same material with the same length have different diameters. Wire A has twice the diameter of wire B. If the resistance of wire B is *R*, then what is the resistance of wire A? (*a*) *R* (*b*) 2*R* (*c*) *R*/2 (*d*) 4*R* (*e*) *R*/4

14 •• Discuss the difference between an emf and a potential difference.

26 •• An 80.0-m copper wire 1.0 mm in diameter is joined end to end with a 49.0-m iron wire of the same diameter. The current in each is 2.0 A. (*a*) Find the electric field in each wire. (*b*) Find the potential drop across each wire.

28 •• A variable resistance R is connected across a potential difference V that remains constant. When $R = R_1$, the current is 6.0 A. When R is increased to $R_2 = R_1 + 10.0\ \Omega$, the current drops to 2.0 A. Find (*a*) R_1 and (*b*) V.

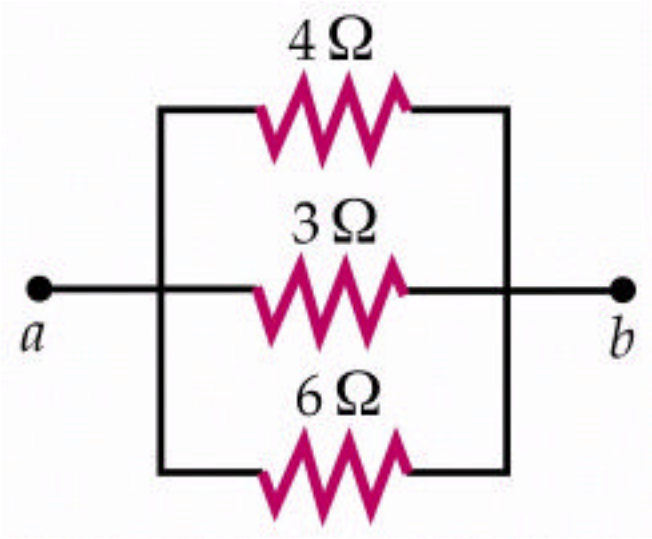
40 •• A toaster with a Nichrome heating element has a resistance of 80 Ω at 20°C and an initial current of 1.5 A. When the heating element reaches its final temperature, the current is 1.3 A. What is the final temperature of the heating element?

46 • The power dissipated in a resistor is P when the voltage drop across it is V. If the voltage drop is increased to 2 V (with no change in resistance), what is the power dissipated? (*a*) P (*b*) $2P$ (*c*) $4P$ (*d*) $P/2$ (*e*) $P/4$

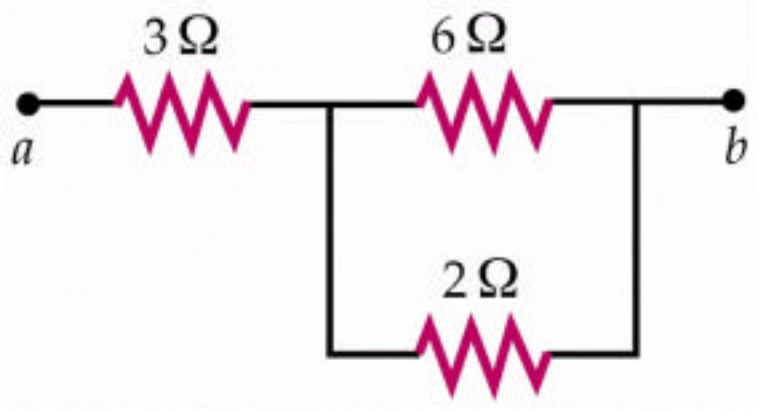
54 • A battery with a 12-V emf has a terminal voltage of 11.4 V when it delivers a current of 20 A to the starter of a car. (*a*) How much power is delivered by the emf of the battery when it delivers a current of 20 A? (*b*) How much of this power is delivered to the starter? (*c*) By how much does the chemical energy of the battery decrease when it delivers a current of 20 A to the starter for 3 min? (*d*) How much heat is developed in the battery when it delivers a current of 20 A for 3 min?

65* •• When two identical resistors are connected in series across the terminals of a battery, the power delivered by the battery is 20 W. If these resistors are connected in parallel across the terminals of the same battery, what is the power delivered by the battery? (*a*) 5 W (*b*) 10 W (*c*) 20 W (*d*) 40 W (*e*) 80 W

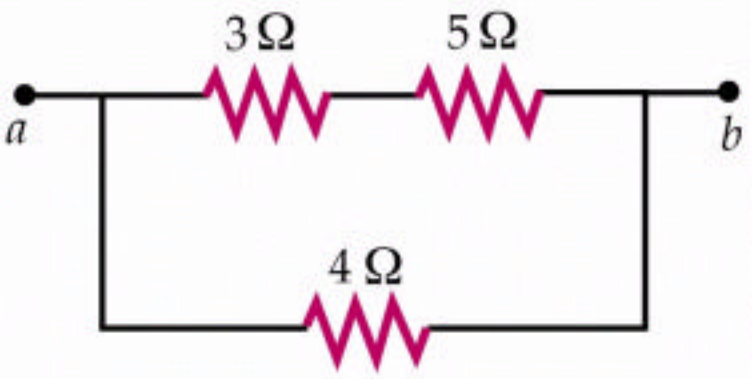
66 • (*a*) Find the equivalent resistance between points *a* and *b* in Figure 26-46. (*b*) If the potential drop between *a* and *b* is 12 V, find the current in each resistor.



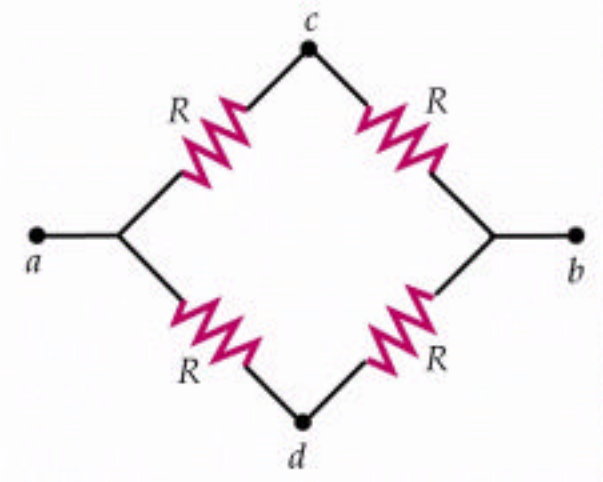
67 • Repeat Problem 66 for the resistor network shown in Figure 26-47.



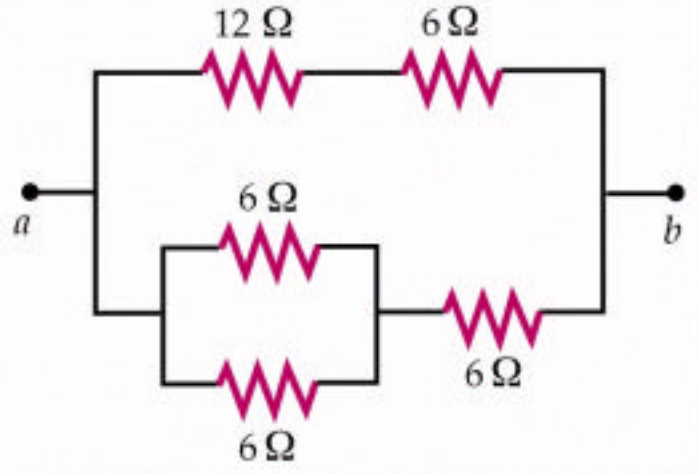
68 • Repeat Problem 66 for the resistor network shown in Figure 26-48.



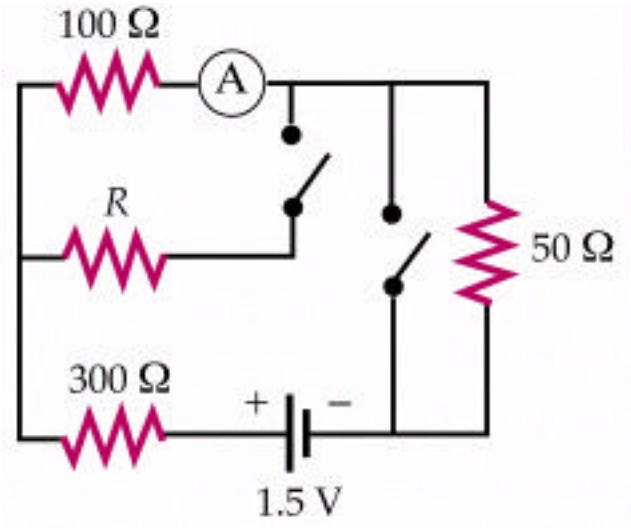
70 • (*a*) Show that the equivalent resistance between points *a* and *b* in Figure 26-49 is *R*. (*b*) What would be the effect of adding a resistance *R* between points *c* and *d*?



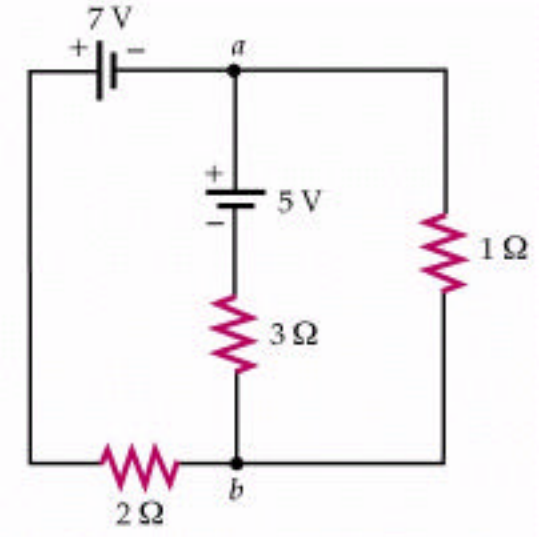
74 •• Repeat Problem 66 for the resistor network shown in Figure 26-51.



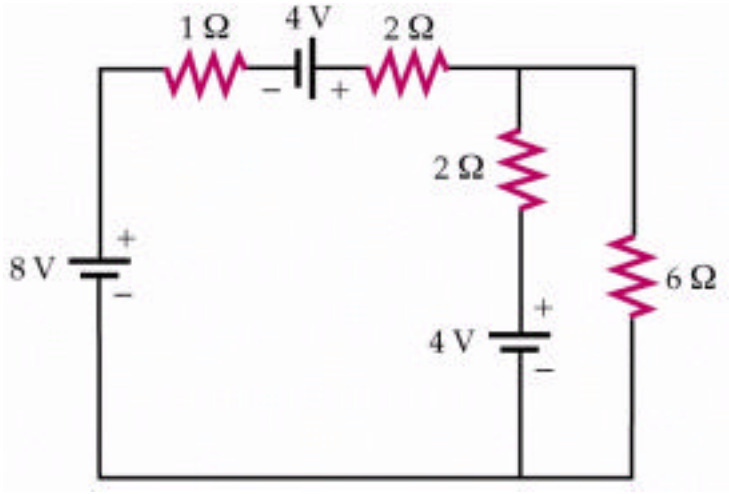
85* •• In the circuit in Figure 26-57, the reading of the ammeter is the same with both switches open and both closed. Find the resistance *R*.



88 •• In the circuit shown the batteries have negligible internal resistance. Find (a) the current in each resistor, (b) the potential difference between points *a* and *b*, and (c) the power supplied by each battery.



90 •• For the circuit in Figure 26-61, find (*a*) the current in each resistor, (*b*) the power supplied by each emf, and (*c*) the power dissipated in each resistor.



101*•• A battery is connected to a series combination of a switch, a resistor, and an initially uncharged capacitor. The switch is closed at $t = 0$. Which of the following statements is true?

(*a*) As the charge on the capacitor increases, the current increases.

(*b*) As the charge on the capacitor increases, the voltage drop across the resistor increases.

(*c*) As the charge on the capacitor increases, the current remains constant.

(*d*) As the charge on the capacitor increases, the voltage drop across the capacitor decreases.

(*e*) As the charge on the capacitor increases, the voltage drop across the resistor decreases.

105*• A 6-μF capacitor is charged to 100 V and is then connected across a 500-Ω resistor. (*a*) What is the initial charge on the capacitor? (*b*) What is the initial current just after the capacitor is connected to the resistor? (*c*) What is the time constant of this circuit? (*d*) How much charge is on the capacitor after 6 ms?

110 •• Consider the circuit shown in Figure 26-68. From your knowledge of how capacitors behave in circuits, find (*a*) the initial current through the battery just after the switch is closed, (*b*) the steady-state current through the battery when the switch has been closed for a long time, and (*c*) the maximum voltage across the capacitor.